# Two-Player Game AI

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## Introduction

- Artificial Intelligence (AI) is an important field in computer science. The focus of AI is creating intelligent machines capable of solving problems as a human would.
- The general purpose of AI is to create a program capable of imitating some aspect of humans.
- While the goal of this project is simple in nature, there is much more behind the scenes than may be expected.
- Because computers are able to solve equations more quickly than humans, having computers capable of being able to learn will enable huge advances in technology.
- AI is also used in many video games. Being able to develop AI is a huge asset when creating video games.

## Project Overview

- My goal with this project is to gain an understanding of how AI's work. My method for doing this is to develop one.
- This project includes the creation of an AI capable of participating in a two-player game. This is programmed in C++.
- The first game is tic-tac-toe.
- The second game is rock, paper, scissors.
- From these, a better understanding of AI will develop.
- The simple nature of these two games makes the ideas behind them easier to understand.
- An understanding of Ai is of great use in many fields in computer science. Skills in this field can be expanded upon to reach into many different areas.

## Materials/Methods

| Materials | Quantity |
|---|---|
| Computer | 1 |
| Visual Studio | 1 |

- The creation of this was done by reasoning. By figuring out the concepts of a game and the steps that need to be taken to win, the logic behind an AI that is capable of winning the game is an easy next step.
- The games were initially tested by playing against them manually. This method allows for exact scenarios to be created, seeing how the AI reacts to it.
- Two copies of the AI have also been made to play against each other.

## Progress

- Currently, the tic-tac-toe AI works by knowing which move it wants to make and going through a list of the best moves it can make in the given situation. While this is similar to how an AI works, it can be improved.
- In the future, the tic-tac-toe game will work off of a min-max algorithm. It will look at the potential moves it can make and then from that, see which one is the best and which will lead to the highest chances of success. This is in development but not yet completed.
- The rock, paper, scissors game is currently able to play the game with some prediction involved.
- In the future, it will use pattern prediction to try and predict which move a player will make next. This is also in development but is not currently working.

## Results

- The tic-tac-toe game, when played against a player, either always wins or the game results in a draw. Due to the nature of tic-tac-toe, when played correctly, it is possible to never lose a game. This means the tic-tac-toe game AI is a success.
- When two tic-tac-toe AI's are faced against each other, the game always results in a draw. This is also a success. This case means that the Ai's are both playing perfectly and that the second player is able to prevent the first player from ever winning.
- The rock, paper, scissors game currently plays as most people would, resulting in an average of a 33% win rate, a 33% lose rate, and a 33% draw rate. This is accurate results for how a human would play.
- When two rock, paper, scissors AI's are put against each other, the results are similar, resulting in an even spread among rounds. This is also an accurate representation of how it would be if two people were to blindly play against each other without much of a strategy in mind.

## Conclusion

- The results so far show that everything is on the correct track. The AI's are heading in the directions they should be.
- The tic-tac-toe game currently is successful. It is able to replicate a human playing the game with the correct strategy in mind. The next step for this is to have it think more about what it is doing, and aim to get the same results that are achieved now. This should not be difficult after implementing a min-max algorithm.
- With both in place, it will also be possible to test both versions against each other to make sure the min-max version is as capable as the current in playing the game.
- The rock, paper, scissors AI also does what it is created to do, but it can do it better. The ability for computers to remember what has happened previously better than a human will be used for this, keeping track of the moves that have been made to predict how that player will next act.
- Both of these and more will be expanded on in the future.